The habit here is much the same, though less densely cespitose, and the palmately divided and nerved leaves are more scattered. The flower and fruit show other differences of more or less importance. The margin of the disk that lines the calyx-tube is more thickened and crenately lobed, and outside this margin, as in the other species, are inserted the distinct stamens approximately in one row, of which those opposite to the middle of the sepals are filiform to the base. The seeds have a loose testa much longer than the embryo, similar to those found in *Sorbaria* (*Spiræa sorbifolia*, etc.).

Unlike as these species are, yet they are more nearly related to each other than either of them is to any other species that has ever been included in *Spiræa*. If *Eriogynia pectinata* is rightly separated from *Spiræa*, as I think, then *S. cæspitosa* should rather be joined with it than retained in *Spiræa*, and with it should go our new species, which I have accordingly named *E. uniflora*. The marked differences between these species, so marked that some would probably consider them generic, justify the designation of three sections, *Eriogynia* proper, *Petrophytum*, and *Kelseya* for *E. pectinata*, *E. cæspitosa*, and *E. uniflora* respectively, the distinguishing characters of which are obvious.

Cambridge, Mass.

Contributions to the knowledge of North American Sphagna. IV.

C. WARNSTORF.

VI. Sphagna subsecunda.

A. *Leaves on both sides entirely without pores; rarely on the outer side with appearances of resorption, here and there, between the very strong and prominent fibril-bands, in the apical half of the leaf. Chlorophyllose cells in cross section broad-rectangular to broad parallel-trapeziform, with very thick walls, especially on the free-lying outer side, the lumen small, roundish-oval. Stem nearly branchless or with 1 or 2 (very seldom 3) uniform branchlets; isophyllous, the stem leaves very slightly larger.*

24. *S. Pylaiei* Brid. Bryol. Univ. 1. Suppl. p. 749 (1827).

Syn.: *S. sedoides* Brid. Bryol. Univ. 1. Suppl. p. 750 (1827).
Hemitheca Pylaiei Lindb. MSS. 1879.

Newfoundland (*de la Pylaie*); New York (*Peck*); New Hampshire (*James*); New Jersey (*Austin*); Carolina (*Sullivant*); Miquelon Island (*Delamare*).

Var. **ramosum** WARNST. in Samml. Europ. Torfm. Serie I, no. 98 (1888). Stem with 1 or 2 (rarely 3) branchlets in a fascicle, pendent branches wanting.

f. *nigricans* BRID. Tufts above black or blackish brown, below brown or more or less blanched.

Miquelon Island (*Delamare*); N. Hampshire, Mt. Willey, 2,500 ft. (*Faxon*).

f. **versicolor** WARNST. Tufts above and in the middle part green and brown or blackish spotted.

N. Hampshire, Mt. Willey, 2,500 ft. (*Faxon*).

f. **ferruginea** WARNST. Plants above red- or dirty-brown, below more or less blanched.

N. Hampshire, Mt. Willey, 2,500 ft. (*Faxon*).

Var. *sedoides* (BRID.) LINDB. Stem nearly or quite simple, without branches. This form I have not yet seen from N. America, but only from France (*Finistere*), collected by Dr. Casnus and de la Pylaie in Herb. Bridel.

Lindberg, in Hvitmossor (1882), refers S. Pylaiei, and with it *S. cyclophyllum* Sull. and Lesq., to a separate group, HEMITHECA, because both species are furnished with a semi-globose capsule. S. Fitzgeraldi also has a similar hemispherical fruit, but it nevertheless belongs to the CUSPIDATUM group. It seems to me that it is improper to found groups on the form of the sporogonium, especially in the Sphagna, because usually in the most widely different divisions it has the same form and exhibits no anatomical distinctions. According to Limpricht (Kryptogamenfl. von Deutschl. Bd. IV, p. 135) the capsule of S. Pylaiei is *destitute of stomata*. As it appears however that this species very rarely fruits, I think that even this peculiarity in the structure of the capsule is not competent to serve as a group character. In habit, form of leaves and the position of the chlorophyllose cells, this species agrees quite well with the SUBSECUNDA; wherefore I place it, as also S. cyclophyllum, in that group. I have seen neither fruits nor male plants of S. Pylaiei.

B. *Branch leaves always porose. Fibril-bands with a meniscoid projection inward. Chlorophyllose cells in cross section narrow-rectangular to narrow-trapezoidal or nearly tunshaped, free on both sides and only on the two external walls somewhat thickened, lumen longish-elliptical. Stem either nearly branchless or with 3 to 5 dimorphous branchlets in a fascicle.*

a. Stem cortex formed of two or more layers of cells.

a. Stem leaves very large, broad roundish-oval, throughout furnished with fibrils, which in the parts near the chlorophyllose cells are regularly connected by cross fibrils; within the latter, on the outside of the leaf, lie numerous pores in rows, like strings of pearls. Stem usually quite simple, rarely with single branchlets.

25. *S. cyclophyllum* SULL. AND LESQ. in Musc. Bor.-Am. 1 ed. (1856).

Syn.: *S. obtusifolium δ. turgidum* Hook. in Drumm. Musc. Am. 2d Coll. No. 17 (1841).

S. Caldense β. scorpioides Hpe. (Glazion n. 7042) in Herb. Copenh.

S. laricinum var. *cyclophyllum* Lindb. in Act. Soc. Sc. Fenn. 10, p. 280 in add. (1872).

S. Drummondii Wils. MSS. Braithw. II. cc. as synon.

Hemitheca cyclophylla Lindb. MSS. 1882.

New Orleans (*Drummond*); Alabama (*Lesquereux*); N. Jersey (*Austin*).

Cardot, in Rév. des Sphaignes de l' Amérique du Nord (1887), p. 12–13, considers this species as an incompletely developed form of S. subsecundum. There is indeed no doubt that the thick branchless stem structure of this species gives the impression that it may be a young plant of some subsecundum form; but the almost regular linking of the fibril-bands by the cross-fibres, between which on the outer surface lie the numerous strong-ringed pores in pearl-string rows, at once gives to the cell network, under the microscope, a remarkable appearance, not repeated in any other species of the subsecundum group yet known to me, although I have already examined about forty, in part published, in part new exotic species, of this the most difficult of all the Sphagnum groups.

With respect to habit as well as to the form of leaf S. cyclophyllum stands, at all events, the nearest to *S. Caldense* C. Müll. (Bot. Zeit. 1862); the latter however has very few pores on either side of the leaves, and on both sides the pores usually stand singly in the apical half of the leaf, especially in the angles of the cells, or even several near each other on the outer side: the stem cortex I have found to be formed of one stratum of cells, whereas in S. cyclophyllum it is irregularly formed of several strata. For these reasons I must pronounce S. cyclophyllum a good characteristic species of the SUBSECUNDUM group, but which by no means deserves to be considered the type of a separate group (HEMITHECA Lindb.).

β. Stem leaves large, in form and areolation quite similar to the branch leaves, fibrillose quite to the base and narrowly bordered. Fibrils on both sides of the leaf at the base not united by cross-fibrils; pores in the upper half of the leaf on the outer surface extremely small, close to the commissures.

26. *S. platyphyllum* (SULL., LINDB.) WARNST. in Flora, 1884.

Syn.: *S. neglectum* Aongstr. (1864), Aust. Musc. Appal. n. 26, 1870.
S. subsecundum β. isophyllum Russ. Beitr. p. 73 (1865).
S. platyphyllum, nov. sp.? vel var. *S. neglecti?* Sull. MSS. 1868.
S. laricinum γ. platyphyllum (Sull.) Lindb. Notiser, Heft. 13, p. 403 (1874).

By Cardot, in Rév. des. Sphaignes de l' Amérique du Nord, p. 13, this species is attributed to New Jersey.

Massachusetts, Boston, 75 ft. (*Faxon*), Essex Co., 75 ft. (*Robinson*).

This species, with respect to its stem leaves, stands in the same relation to *S. contortum* Schultz (*S. laricinum* Spruce) as S. rufescens and S. obesum do to S. subsecundum. The specimens of S. platyphyllum from N. America examined by me agree in all points with the European plant. Hitherto I have seen no male plants except those collected by Dr. Beckmann at Bassum in Hannover (Germany); the fruit is yet unknown.

γ. Stem leaves small, linguiform, with a border widened downward. Hyaline cells fibrillose only near the apex of the leaf; always well differentiated from the branch leaves. Pores on the outer surface of the branch leaves in the apical part extremely small, isolated, or several in interrupted rows on the commissures.

27. *S. contortum* SCHULTZ in Prodr. Fl. Starg., Suppl. no. 93 (1819).

Syn.: *S. laricinum* Spruce, MS. 1847.
S. contortum δ. laricinum Wils. Bryol. Brit. p. 23 (1855).
S. cavifolium Warnst., var. 2 *laricinum* (Spruce) Europ. Torfm. p. 86 (1881).

Ohio; New Jersey; New York; Massachusetts, Essex Co., 75 ft. (*Robinson*).

In Hedwigia, 1888, pp. 266 and 267, I expressed the opinion that the true S. contortum of Schultz had been hitherto by most bryologists erroneously placed among the forms of S. subsecundum. But since Limpricht and I have had the

opportunity to examine several original specimens (such I have had before me in Herb. Bridel and in Funck, Deutschlands Moose) it is unquestionable that Schultz's moss is identical with S. laricinum Spruce, therefore the latter must hereafter bear the name S. contortum. Whether the var. Floridanum Ren. et Card. in Rev. Bryol. 1885, p. 46, belongs to S. laricinum or to S. platyphyllum I can not decide for lack of authentic specimens.

b. Stem cortex formed of a single stratum of cells, rarely with isolated cells divided by a longitudinal wall.

a. Stem leaves small to medium-sized, with a border more or less widened downward; hyaline cells near the apex fibrillose. Inner pores of the branch leaves scanty, especially in the upper and lower angles of the cells. Outer pores very numerous on nearly the whole surface of the leaf, at the commissures in rows like strings of pearls.

28. *S. subsecundum* NEES in Sturm, Deutschl. Flora 2, fasc. 17 (1819).

Syn.: *S. contortum* var. *subsecundum* Wils. Bryol. Brit. p. 22 (1855).
S. Lescurii Sull. Moss. U. S. p. 11 (1856).
S. subsecundum a. heterophyllum Russ. Beitr. p. 72 (1865).
S. cavifolium var. 1. *subsecundum* Warnst. Europ. Torfm. p. 81 (1881).

Probably as abundant in the northern parts of North America as it is in Europe and in numerous forms.

New Hampshire, Crawford House, 1,900 ft., Franconia, 1,000 to 2,000 ft.; Mass., Boston, 75 ft., Brookline and Dedham, 75 ft., Bedford, 100 ft. (*Faxon*).

The var. *pseudo-molle* Ren. et Card. Rev. Bryol. 1885, p. 45, from Florida according to Cardot in Rév. des Sphaignes p. 12, is unknown to me; he ascribes to it great softness and the habit of S. molle and remarks that the stem cortex is wanting or indistinct.

β. Stem leaves large, oval-linguiform, the lateral margins narrowly and uniformly bordered down to the base; hyaline cells fibrillose from the apex far downward, often quite to the base, and with small pores on both sides. Branch leaves large, *on the inner side with numerous small pores, in the vicinity of the margins sometimes in rows, on the outer side still more numerous, in rows like strings of pearls, on the commissures.*

29. *S. rufescens* BRYOL. GERM. p. 15, tab. II, fig. 6* (1823), Limpr.

Syn.: *S. contortum* Nees, Schpr., Lindb. and others.

Massachusetts, Boston 100 ft. (*Faxon*).

This species, which is sometimes as tall and stout as the following, is distinguished from the genuine S. subsecundum as well as from S. obesum, by the pore structure of the branch leaves. The pores are always numerous on both sides (although less so on the inner) and are small with strong rings. The color of the tufts is sometimes grass- or gray-green, sometimes brownish red or dappled with green and red. The plant is a water-lover, but also occurs in drier situations; it is seldom found completely submersed and floating in water like the following species.

γ. Stem leaves in form and cell-structure like the preceding but with fewer pores on both sides. Hyaline cells, as a rule, fibrillose quite to the base. Branch leaves large, either with few pores on both sides, or on the outer side with somewhat more numerous pores in nearly all the cell-angles, but never in uninterrupted rows as in the preceding species.

30. *S. obesum* WILS. Bryol. Brit. p. 22 (1855).

Syn.: *S. subsecundum* var. *turgidum* C. Müll. Synops. I, p. 101 (1849)?
S. turgidum (C. Müll.) Röll, Flora, 1886?
S. decipiens Sull. et Lesq. in Herb. Kew.

Virginia (*Lesquereux*); New Hampshire, Crawford House, 1,900 ft.; Mass., Lynn, 50 ft., Boston, 50 ft. (*Faxon*).

This is a truly aquatic plant; it is usually found quite submersed and floating. Its color is, like that of the preceding species, extremely variable, sometimes grayish green, sometimes dark brownish-red, sometimes variegated. It generally assumes a plumose habit similar to that of certain aquatic forms of the CUSPIDATA. It may always be with certainty distinguished from the forms of the preceding species, which it often closely resembles in habit, by the much scantier pores in the branch leaves, which, even if more numerous on the outer side, never occur in uninterrupted rows like strings of pearls, but only more plentifully distributed in the angles of the cells.

Standing the nearest to Sph. obesum in habit is a species very recently distinguished by me, *Sph. crassicladum*, from England (Bot. Centralblatt, 1889, no. 45). The branch leaves are very large, broad roundish-ovate to longish-ovate, nearly flat, with margins not involute; the apex broadly truncate and 7 to 9-toothed; the border 3 to 5 cell-rows wide. When dry the leaves are slightly glossy and the margins feebly undulate. The hyaline cells are furnished with numerous inwardly meniscoid-projecting fibril-bands, and the fibrils in the upper two-thirds to three-fourths of the leaf on

the inner side are connected with each other by cross-fibrils which enclose rows of small pores. On the outer side in the apical part of the leaf the fibrils are partially connected by delicate, often incomplete, cross-fibrils which only rarely enclose one pore, therefore, here especially, the pores only occur in the upper, or sometimes in the upper and lower angles of the cells; in the basal half of the leaf near the margins the pores are more numerous, sometimes in interrupted rows on the commissures. The pore distribution however is always the reverse of that of S. rufescens, since *the pores are the most numerous on the inner side of the leaf.*

This species must certainly be found also in North America, wherefore I have taken the liberty to draw attention to it.

According to my observations hitherto I conclude that, in the SUBSECUNDUM group, so far as the European and North American species are concerned, the number and distribution of the pores on the two surfaces of the leaf must be considered of the highest importance, and deserve to be taken into account in distinguishing the several types. But this is only possible when we employ, in the investigation of the various forms, the staining process. We shall then find that the pores occur—either very abundantly only on the outer side and very scantily on the inner side (S. subsecundum and S. cyclophyllum),—or conversely they are more numerous on the inner side than on the outer (S. crassicladum),—or on both sides numerous (S. rufescens),—or on both inner and outer scarcer (S. obesum),—or on both sides (the membrane-gaps which sometimes occur on the outside being left out of the account) without pores (S. Pylaiei).

VII. Sphagna cymbifolia.

a. Transverse walls of the cortical cells of the branches saccately curved downward, so that the cells appear set into each other like a nest of boxes, therefore the branch cortex in cross-section (the downwardly curved transverse walls being frequently cut through also) often seems to be composed of three layers of cells. Hyaline cells of the branch leaves twice as wide as in the next group; chlorophyllose cells in cross section equilateral- to isosceles-triangular, inserted between the hyaline on the inner side of the leaf and here free, on the outer side entirely included. Hyaline cells at the base of the leaf, so far as they are united to the chlorophyllose cells, furnished internally with comb-fibrils.

31. *S. Portoricense* HAMPE in Linnæa, 25, p. 359 (1852).

Syn.: *S. Sullivantianum* Aust. in Am. Jour. Sc. and Arts, 1863, p. 252. *S. Herminieri* Schpr.

N. Jersey (*Austin*, *Rau*); Florida; Louisiana, according to Cardot in Rév. des Sphaignes de l' Amérique du Nord.

In Hedwigia, 1889, p. 303–308, I attempted to show that this species, on account of its anatomical structure, should be placed among the forms of *S. imbricatum* (Hornsch.) Russ.= *S. Austini* Sull. But I did not then in my investigations take into consideration the structure of the cortex of the branches wherein the two species differ from each other, so now I do not hesitate to accord to S Portoricense its right to the rank of a distinct species, by reason of the peculiar saccately curved transverse walls of the cortical cells of its branches, such as I have observed in no other exotic species of the CYMBIFOLIA.

b. Transverse walls of the cortical cells of the branches not bent downward but level, the cells much narrower than in the preceding; the hyaline cells of the branch leaves usually only half as wide. Chlorophyllose cells in cross section usually equilateral-triangular, placed on the inner side between the hyaline cells, on the outside completely enclosed. The hyaline cells within, so far as they are united to the green cells, usually furnished with comb-fibrils, which occur sometimes abundantly, sometimes only scantily near the base of the leaf, and sometimes, though rarely, are entirely wanting.

32. *S. imbricatum* (HORNSCH.) RUSS. Beitr., p. 21 (1865).

Syn.: *S. Austini* Sull. in Aust. Musc. Appal. p. 3 (1872).

New Jersey (*Austin*); Miquelon Island (*Delamare*); Louisiana and Mississippi (*Langlois*); Newfoundland; Massachusetts.

This species, like S. cymbifolium, is very inconstant in habit, and also undergoes many variations with respect to color. The characteristic comb-fibrils within the hyaline cells of the branch leaves are sometimes very numerous and well developed, sometimes they appear only near the base of the leaf with more or less distinctness, and indeed may be sometimes entirely wanting. The knowledge of these facts I have gained from the abundant material, for which I am indebted to the kindness of Mr. Faxon. The plants collected by him in the vicinity of Boston, Mass., show these relative characters with a clearness that leaves nothing to be desired. In the same manner I have also learned that the *S. affine* Ren. et Card., in Rev. Bryol., 1855, p. 44, from the state of New York, is to be considered as only a form of S.

imbricatum without comb-fibrils, which frequently has squarrose branch leaves. The plant from Florida, with chlorophyllose cells, broad-trapeziform in cross section and free on both sides, provisionally I can not include here. In an article, "Welche Stellung in der Cymbifoliumgruppe nimmt das S. affine ein?" (Hedwigia, 1889, pp. 367–372), I have expressed my opinion at length, and therein stated that with regard to the occurrence of comb-fibrils in S. imbricatum three principal forms may be distinguished:

1. Var. *cristatum* with numerous comb-fibrils occurring in the lower half of the branch leaves,

2. Var. *sublæve* with slender beginnings of comb-fibrils in the hyaline cells near the base of the leaf, and

3. Var. *affine* (Ren. et Card.) entirely free from comb-fibrils.

Each of these three forms Mr. Faxon has collected near Boston, and has communicated to me in numerous and beautiful specimens, and also all three with distinctly squarrose leaves, so that there is of each variety a f. *squarrosula*. European specimens of these squarrose-leaved forms are not yet known to me nor those in whose leaves the comb-fibrils are entirely wanting, and which would correspond to the var. affine. These squarrose-leaved forms of S. imbricatum are analogous to *S. cymbifolium* var. *squarrosulum*, Bryol. Germ. (1823)=*S. glaucum* v. Klinggr. (1880).

c. Transverse walls of the cortical cells of the branches as in b. Chlorophyllose cells of the branch leaves in cross section narrow isosceles-triangular to triangular-elliptic or isosceles-trapeziform, placed on the inner side of the leaf between the hyaline cells and here always free, on the outside enclosed or with free outer walls. Hyaline cells internally, so far as they are united to the chlorophyllose cells, either quite smooth or faintly to strongly papillose. Stem cortex with abundant fibrils and usually with numerous pores in the external walls.

33. *S. cymbifolium* Ehrh. Hannov. Mag. 1780, p. 235.

Syn.: *S. obtusifolium* Ehrh. Pl. Crypt. no. 241 (1793).
S. latifolium Hedw. Sp. Musc. p. 27 (1801).
S. oblongum P. B. Prodr. p. 88 (1805).
S. crassisetum Brid. Sp. Musc. I. p. 15 (1806).
S. pseudo cymbifolium C. Müll. Linnæa. 1874, p. 547.
S. subbicolor Hampe in Flora 1888, p. 400.
S. australe Schpr. Original in Herb. Bescherelle.
S. Whiteleggei C. Müll. Flora 1887, p. 408.
S. Cionotum C. Müll. Flora 1887, p. 408.

In North America as common as in Europe.

According to the development of the papillæ in the branch leaves I distinguish:

Var. **læve** WARNST. with perfectly smooth inner walls of the hyaline cells; here belongs also

f. *glaucescens* s. f. *squarrosula* (BRYOL. GERM.).

Plants usually blue-green; branch leaves with squarrose-spreading tips. This plant is the *S. glaucum* v. Klinggr. (1872).

Massachusetts, Brookline, 75 ft. (*Faxon*).

Var. *sublæve* LIMPR., with very indistinct papillæ on the internal walls of the hyaline cells, in part wholly wanting.

Of this variety I have hitherto seen no North American specimens.

Var. *papillosum* (LINDB.) SCHPR. Synops. Ed. II, p. 848 (1876).

Syn.: *S. papillosum* Lindb. in Act. Soc. Sc. Fenn. 10, p. 280 (1872).

Hyaline cells within, so far as they are united to the chlorophyllose cells, thickly and distinctly papillose.

Canada; Miquelon Island; New Jersey; Pennsylvania; New Hamsphire, Crawford's, 1,900 ft., Mt. Willey, 2,500 ft., Mt. Cannon, 2,500 ft.; Mass., Brookline, 75 tt. (*Faxon*).

With respect to the development of the papillæ in S. papillosum the case is exactly the same as in other species; sometimes these incrassations are extremely numerous, sometimes they almost disappear, and sometimes they occur very unequally on the same plant; so it is in S. Wulfianum, S. teres, S. squarrosum and in various exotic species of the RIGIDUM group. I can therefore see in *S. papillosum* Lindb. only the papillose form of S. cymbifolium, and can not even concede to it the rank of a subspecies. There is here a quite similar condition, with regard to the development of the papillæ, to that which exists in S. imbricatum with regard to the comb-fibrils.

In Rév. des Sphaignes, p. 4, Cardot, under S. cymbifolium, adduces a var. *Ludovicianum* Ren. et Card. from Louisiana and Mississippi, in which the cortex of stem and branches is scantily furnished with fibrils and whose stem-leaves are dimorphous. I have not seen it and therefore can not make any comments on it.

d. Transverse walls of the cortical cells of the branches the same as in **b** and **c**. Chlorophyllose cells in cross section elliptic, central and on both sides enclosed by the hyaline cells. Wood cylinder

dark red; stem cortex with few fibrils, sometimes almost free from them, and with few pores in the external walls. Inner walls of the hyaline cells, so far as they are united to the green cells, smooth or papillose.

34. *S. medium* LIMPR. Bot. Centralbl. 1881, p. 313.

Syn.: *S. cymbifolium*, var. *congestum* Schpr. Entw.-Gesch. d. Torfm. p. 69 (1858).

S. cymbifolium, var. *purpurascens* et var. *compactum*, Russ. Beitr. p. 80 (1865).

S. Andinum Hampe in Ann. Sc. Ser. 5, 1866, p. 334.

S. arboreum Schpr. in Herb. Kew. (Peru).

S. ovatum Schpr. in Herb. Kew.

S. crassum C. Müll. in Herb. Rom.

S. bicolor Besch. in Bull. de la Soc. Bot. de France, p. lxviii (1855).

S. cymbifolium, var. *Paradisi*, Besch. in Herb.

S. erythrocalyx Hpe. C. Müll. Synop. I, p. 92 (1849).

S. Peruvianum Mitt. in Musc. Austro-Amer. p. 625 (1869).

S. tursum C. Müll. Flora 1887, p. 410 (Brazil).

S. Hahnianum C. Müll. 1889, in litt. (Chili).

This species is diffused throughout the whole of America from Canada to Patagonia, and in numerous forms which have given rise to the proposing of many species. It seems, therefore, imperative in this place to subjoin a full description of S. medium.

Dioicous; male branchlets purple. Size and habit of S. cymbifolium, but with the tufts *variegated*, dappled with green and red to violet-purple, often only the male amentula faintly suffused with red; rarely pure green or white. Branches not more than four, of which two are spreading, strong thick-fusiform, horizontal or ascending, often curved, obtuse, more rarely short-pointed. Wood cylinder *purple or rose-red*, shining through the cortex. Stem cortex mostly composed of 4, rarely of 3 or 5, layers of cells, the superficial cells half as large as the others, scantily provided with weak fibrils or with none, and with 1 or 2 pores on the outside. Stem leaves as in S. cymbifolium, sometimes larger, sometimes smaller, spatulate; hyaline cells free from fibrils, or in the upper part fibrillose and on the outer side porose. Branch leaves variously shaped, sometimes densely sometimes loosely imbricated. Cortical cells of the spreading branches usually with fibrils, very rarely without; pore-structure on both sides of the leaf similar to that of S. cymbifolium. Chlorophyllose cells in cross section small, *elliptical*.

central and completely enclosed on both sides by the biplane hyaline cells. In plants with loosely spreading leaves the chlorophyllose cells in the apical part of the leaf are free on both sides, although central. Inner walls of the hyaline cells, so far as they are united to the green cells, *smooth or papillose*. Upper perichætial leaves with a prolonged rounded point, in the upper half with fibrils and a few pores; above fimbriate all around. Spores 0.024 to 0.028 mm. diam. in mass rust-colored, minutely punctate.

In Rév. des Sphaignes, p. 5, Cardot pronounces *S. erythrocalyx* Hampe to be a form of *S. papillosum* Lindb., to which, however, the plant can not belong, by reason of the central, elliptical chlorophyllose cells, enclosed on both sides by the biplane hyaline cells, wherefore it must be reckoned among the forms of S. medium. In the European forms the cortical cells of the stem are always furnished with slightly developed, very slender fibrils, but in the tropical forms, such as S. erythrocalyx, S. Hahnianum, S. Peruvianum, etc., the fibrils are entirely wanting in the cells of the stem cortex; indeed, I have seen forms in which the formation of fibrils, even in the cortical cells of the stronger spreading branches, has nearly or wholly ceased, so that one finds distinctly developed fibrils in the cortical cells of the pendent branches only. Furthermore, all the known European forms of S. medium have smooth inner walls of the hyaline cells of the branch leaves, while tropical forms sometimes exhibit an abundance of well developed papillæ; this is, for example, the case in *S. erythrocalyx* Hpe. from Brazil. I have not yet met with forms in which the development of the papillæ has been very feeble, irregular, and therefore indistinct, but I do not for a moment doubt that they will yet be found in S. medium, as already they have been in S. cymbifolium. There may be distinguished, therefore, in S. medium, with respect to the development of the papillæ in the branch leaves, two principal series of forms: 1. var. *læve*, and 2. var. *papillosum*; in the former all the European and North American species will be counted, in the latter *S. erythrocalyx* Hampe.

Var. *læve* f. *purpurascens* (Russ.). Tufts, especially the heads, purple to violet-red, below pale or darker brownish, but not variegated with red and green.

N. H., Lisbon, 1,000 ft.; Mass., Boston and Dedham, 100 ft. (*Faxon*).

f. **versicolor** Warnst. Tufts, as to the heads, more or less red, below green, at the bottom yellowish or whitish, therefore of two or three colors.

N. H., Crawford's, 1,900 ft., Franconia, 1,000 ft.; Vermont, Lake Willoughby, 1,000 ft.; Mass., Brookline and Dedham, 100 ft. (*Faxon*).

f. **virescens** WARNST. Plants, in the upper part pale-, gray- or dark-green, below brown or whitish.

N. H., Mt Washington, 5,000 ft., Crawford's, 1,900 ft.; Vt., Lake Willoughby, 1,000 ft.; Mass., Boston, 100 ft. (*Faxon*).

f. **fuscescens** WARNST. Plants above more or less browned, below bleached out or violet-brown.

Mass., Essex Co. (*Robinson*).

f. **albescens** WARNST. Tufts completely bleached, nearly throughout white. Here belongs *S. Hahnianum* C. Müller from S. America.

Having reached the conclusion of these statements, I can not refrain from earnestly entreating all American bryologists to collect the Sphagna of their respective neighborhoods systematically and more copiously than has, perhaps, heretofore been customary. In doing this, the common as well as the rarer forms should receive attention. Only by doing this can we expect that, in the course of time, more light may be shed on the geographical distribution of the different species and forms. I should, in such event, be cheerfully ready to investigate and report upon any small or large collections of Sphagna that might be sent to me. Small packages can best be sent by mail, at a very small expense of postage, marked "Samples without value." The packages must not exceed 8 inches long, 4 inches wide and 2 inches thick. Each specimen should be numbered, and it is allowable to attach a ticket to each, on which the locality should be noted. It will be all the more agreeable to me to receive such Sphagnum packages from many different regions, because I intend to elaborate the whole of the American Sphagna in a separate treatise.

I hope that this preliminary work may help to excite and heighten the interest in the difficult, indeed, but very remarkable family of the peat-mosses. To Mr. Faxon, who has had the kindness to translate this work into English, I here express my most sincere thanks. May he long continue to take, as heretofore, an active interest in sphagnology.

ADDENDUM.—*Sphagnum Lindbergii.* A weak, compact form of this species has been found in very wet, boggy soil on Mt. Monroe, N. H., alt. 4,200 feet.

The following corrections may also be noted:

p. 133, line 17 from top, for "cuticle" read *cortex*.

p. 138, last line, for "externally" read *extremely*,

p. 133, line 19 from bottom, for "acutifolium" read *acutiforme*.

p. 135, line 9 from bottom, for "ta.b." read *tab*.

p. 137, line 17 from bottom, insert a hyphen after *grayish*.

p. 189, line 15 from bottom, for "looser and" read *looser or*.

p. 218, line 14 from top, for "ranged" read *ringed*.

p. 223, line 14 from bottom, for "serrulatum" read *serrulata*.

p. 226, line 14 from bottom, for "specimens" read *a specimen*.

Neuruppin, Germany, Feb. 6, 1890.

Some recent observations on black-rot of the grape.

B. T. GALLOWAY.

During the summers of 1889 and 1890 we made a series of experiments, with a view of determining, if possible, the relationship existing between the so-called *Phyllosticta labruscæ* Thum., which occurs on the leaves of the cultivated and wild grapes, the *Phyllosticta ampelopsidis* E. & M., occurring on Ampelopsis quinquefolia and A. Vietchii, and the various forms attacking the fruit of the cultivated grape, which, as shown by Scribner and Viala[1], are stages of one fungus, namely *Lastadia Bidwellii*, of Viala and Ravaz.

Without going into details of the work, we will say that something like 200 inoculations of the berries of a dozen or more varieties of cultivated grapes were made from pycnidia-spores obtained from the leaves of Ampelopsis and Vitis; but in no case did we succeed in producing any of the Lastadia forms, or for that matter any disease whatever. Berries of all ages were used in the experiments; some were inoculated as they hung on the vines, and were protected from outside contamination by paper bags; others were brought into the laboratory, and, after being inoculated with germinating spores from the leaves, were placed in damp

[1]Black-rot, Bulletin No. 7. Section Vegetable Pathology, U. S. Department of Agriculture, 1888.